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FLOOD INSURANCE STUDY

CITY OF MILPITAS, CALIFORNIA
SANTA CLARA COUNTY

REVISED: FEBRUARY 19, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER - 060344

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

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FLOOD INSURANCE STUDY

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study has been prepared to revise and update a previous Flood Insurance Study/Flood Insurance Rate Map for the City of Milpitas, Santa Clara County, California. This information will be used by Milpitas to update existing flood plain regulations as part of the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). The information will also be used by local and regional planners to further promote sound land use and flood plain development.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by George S. Nolte and Associates, for FEMA, under Contract No. H-4035. This study was completed in November 1978.

Revisions to riverine flooding adjacent to Coyote Creek in the vicinity of Nimitz Freeway (State Highway 17) between Montague Expressway and Dixon Road were based on information obtained from a report dated October 11, 1983, prepared by the Santa Clara Valley Water District (Reference 1).

1.3 Coordination

The community base map was selected and streams requiring detailed study were identified in a meeting attended by personnel of the Santa Clara County Planning Department, Santa Clara Valley Water District, Federal Insurance Administration, and the Milpitas Department of Public Works.

The following public agencies were contacted during the study to obtain basic data or information concerning previous studies and proposed construction or development within the flood plain: U.S. Army Corps of Engineers, San Francisco District;

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U.S. Geological Survey; State of California Department of Water Resources; State of California Department of Transportation; U.S. Soil Conservation Service; Santa Clara County; Santa Clara Valley Water District; and Milpitas Department of Public Works. In addition, local engineering firms and developers were contacted regarding improvements to specific sites. The California History Center of DeAnza College and private individuals also contributed information.

During the course of the work, flood elevations and flood boundaries were reviewed with community officials and with officials of the Santa Clara Valley Water District.

The results of the work were reviewed at an intermediate coordination meeting attended by personnel of the Santa Clara Valley Water District, the Federal Insurance Administration, and the City of Milpitas. At this meeting, Calera Creek was eliminated from the detailed study due to channel improvements.

The results of this study were reviewed at a final community coordination meeting.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the City of Milpitas, Santa Clara County, California. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through 1989.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the City of Milpitas.

The following portions of streams and reaches were studied by detailed methods:

1. Berryessa Creek, from confluence with Lower Penitencia Creek to corporate limits

2. East Penitencia Creek, from confluence with Lower Penitencia Creek to corporate limits

3. Lower Penitencia Creek, from confluence with Coyote Creek to confluence with East Penitencia Creek

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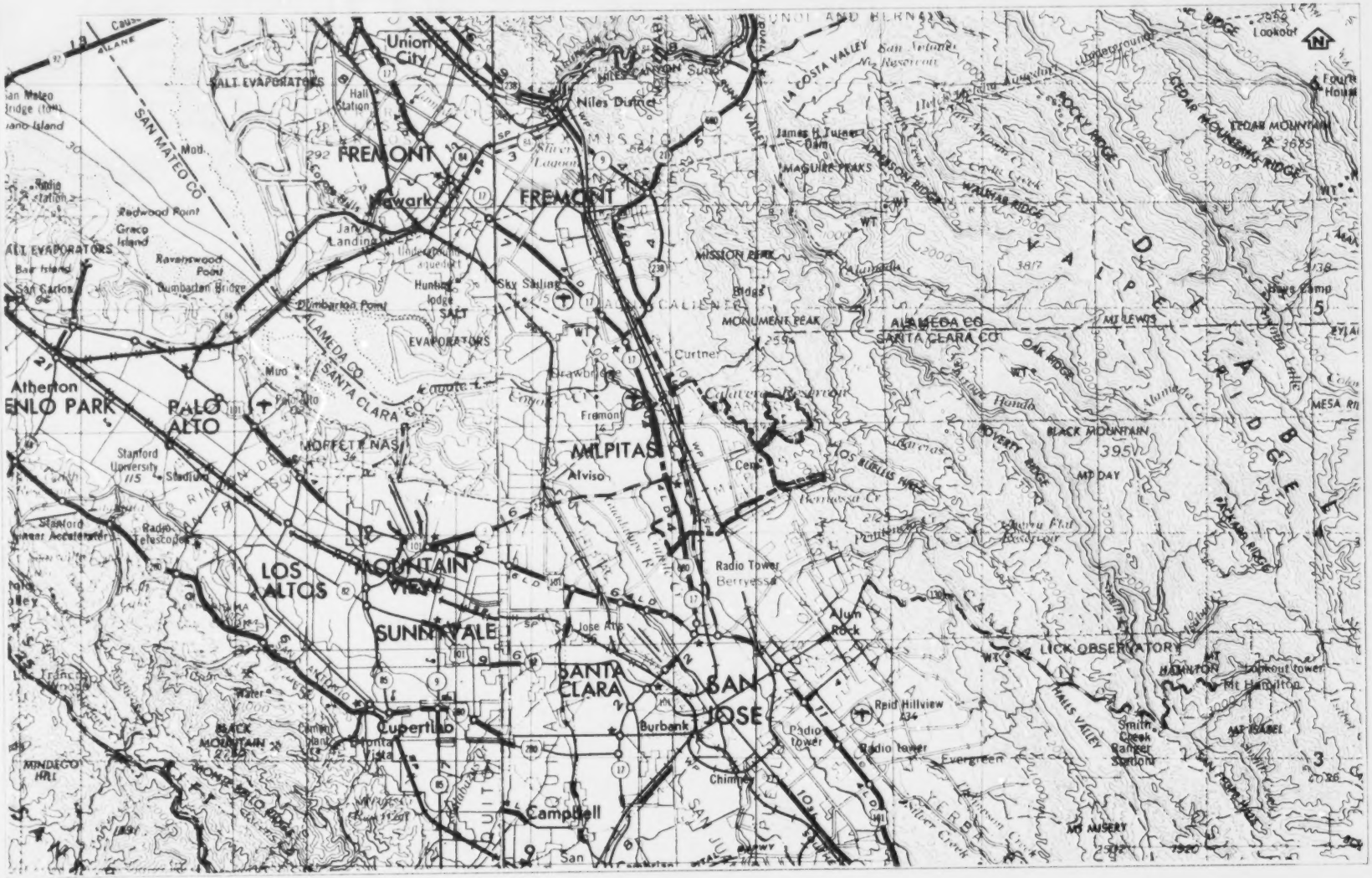
Union City
FREMONT
Newark
Niles District
SALT EVAPORATORS
SAN MATEO CO.
Redwood Point
Greco Island
Ravenswood Point
Dumbarton Bridge
Dumbarton Point
Hunting Lodge
Sky Sailing
ALAMEDA CO.
SANTA CLARA CO.
Atherton
MENLO PARK
PALO ALTO
Stanford University
Stadium
MOFFETT NAS
Stanford Linear Accelerator
Radio Telescopes
LOS ALTOS
MOUNTAIN VIEW
SUNNYVALE
Cupertino
Monta Vista
MILPITAS
Alviso
Fremont
Curtner
Calaveras Reservoir
Los Gilletis Hills
Radio Tower
Berryessa
Jose Ars
SANTA CLARA
SAN JOSE
Burbank
Campbell
Alum Rock
Reid Hillview
Radio Tower
Evergreen
Chimney
Smith Creek Ranger Station
LICK OBSERVATORY
HAMILTON
Mt Hamilton
Lookout Tower
MT ISABEL
MT NUSERY
James H Turner Dam
MAGUIRE PEAKS
MISSION PEAK
MONUMENT PEAK
MT LEWIS
Briggs
Hayes Camp
BLACK MOUNTAIN
MT DAY
OAK RIDGE
ROCKY RIDGE
CEDAR MOUNTAIN
CEDAR MOUNTAIN RIDGE
WALMAR RIDGE
JOHNSON RIDGE
MESA RD
VALPE RIDGE
LA COSTA VALLEY
Underground
Lookout
Four's House
Radio Station
Mud
Coyote
Calaveras Reservoir
Los Gilletis Hills
Calaveras Fault
Hayward Fault
Alameda Creek
Arroyo Hondo
Arroyo Del Valle
Arroyo Valle
Arroyo Las Positas
Arroyo Mocho
Arroyo Del Valle
Arroyo Hall Reservoir
Arroyo Las Positas
Arroyo Mocho
Arroyo Del Valle
Arroyo Valle

Tidal flooding from the San Francisco Bay was also studied in detail as were several sheet flow and ponding areas within the community.

The following portions of streams were studied by approximate methods:

1. Arroyo Los Coches from confluence with Berryessa Creek to 2,300 feet upstream of Piedmont Road

2. Piedmont Creek, North Branch Piedmont Creek, and South Branch Piedmont Creek, from confluence with Berryessa Creek to corporate limits

3. Scott Creek, from corporate limits to 2,000 feet upstream of Interstate Highway 680

4. Calera Creek, from confluence with Berryessa Creek to corporate limits

5. Coyote Creek, for the entire reach within corporate limits

2.2 Community Description

Milpitas is located at the foot of the Diablo Range in northwestern Santa Clara County, in west-central California. The city, encompassing an area of approximately 9.4 square miles, extends from the foothills outward onto the alluvial plain of the Santa Clara Valley toward the San Francisco Bay. The city is approximately 45 miles southeast of San Francisco, 40 miles south of Oakland, and 8 miles north of central San Jose. Milpitas has a common boundary with the northern-most portion of San Jose and with unincorporated areas of Santa Clara County. It also shares a common boundary with Alameda County, California.

Prehistorically, the region that would ultimately become Milpitas was inhabited by Costanoan Indians. Costanoan is from the Spanish, Costanos, or coast people (Reference 2). The descendants of these indigenous peoples preferred the name Ohlone, people of the west, which was given to them by the Yokuts, the Indian group living to the east in the San Joaquin Valley (Reference 3). The Ohlone lived within the watershed lands from the Carquinez Straights on the north to the Carmel River on the south. Their eastern boundary was the interior chain of the coast ranges, the Mount Diablo Range. Thus, their territory included not only all of Santa Clara County, but what is now San Francisco, San Mateo, Contra Costa, Alameda, San Benito, Santa Cruz, and Monterey Counties. Probably no more than 10,000 Ohlone were living in this large domain at any one time (Reference 2).

Recorded history began in the Milpitas area with the coming of the Spanish. During the latter one-half of the 18th century, several Spanish expeditions were sent north from Mexico to strengthen the

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hold on the Californias by Spain. In 1769, Gaspar de Portola led an expedition party north along the California coast. Having passed Monterey Bay, and not recognizing it, Portola's expedition camped a few days at Point San Pedro. Two of his men, who were hunting for food, climbed the northeastern hills. From the summit, they looked down on "a valley like a great inland sea, stretching northward and southeastward as far as the eye could reach" (Reference 4). These were the first Europeans to see the Santa Clara Valley; the date was November 2, 1769. In March 1776, Captain Juan Bautista de Anza passed through what is now Santa Clara County during the expedition which ultimately selected the site for the City of San Francisco. The California missions were subsequently established, laying the foundation for Spanish influence in the area.

In 1821, Mexico gained independence--an event with far reaching consequences for all of California. The missions were secularized, and, under Mexican law, private citizens could petition for lands previously belonging to the missions. Hundreds of large land grants were created throughout the territory.

In what is now the Milpitas area, four land grants were created. The first of these, Tularcitos (Little Tule Thicket), was granted to Jose Higuerea in 1821. This rancho covered 4,394 acres north of Milpitas, extending from Penitencia Creek into the eastern foothills. In 1834, Nicolas Berryessa was granted rancho Milpitas (Little Corn Patches), a 4,457-acre tract extending southward from Calaveras Road to Cropley Avenue and eastward from Milpitas Road to the hills beyond Piedmont Road. In 1838, Rincon de los Esterors (Estuaries Bend) was granted to Ygnacio Alviso. This 6,352-acre rancho extended eastward from the Guadalupe River to the old western outskirts of Milpitas. The last grant in the area, Agua Calinete (Hot Water), was bestowed upon Fulgencio Higuera in 1839. Straddling the Santa Clara-Alameda County line, this rancho was the largest of the four, covering 9,564 acres (Reference 5).

During this period, American pioneers were beginning to penetrate the area. The largest influx of people occurred after the discovery of gold. The Santa Clara Valley, especially San Jose, became a jumping off place for the gold fields and a supply center on the route from Monterey to San Francisco. Ultimately, many discouraged gold hunters settled in the valley.

American interest in California increased steadily, and Mexico and the United States went to war. Mexico had little chance in this dispute, and, with the Treaty of Guadalupe Hidalgo in 1848, it surrendered all of the California territory to the United States.

Livestock, grain, and vegetable crops were important in the early economy of Milpitas. However, it was the coming of the orchards that launched the richest agricultural period in the Milpitas area. Peaches, pears, apricots, and prunes were grown in Milpitas and

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surrounding areas. The growing of fruits and vegetables would remain a basic element of the economy in Milpitas, as well as the entire Santa Clara Valley, until the industrialization of Santa Clara County during the 1950s and 1960s.

The majority of agricultural activities in Milpitas have subsided. Fruit production has ceased to be a significant factor in the city and in neighboring communities. With the advent of technical industries in the Santa Clara Valley, particularly aerospace and electronics, Milpitas has become primarily a residential and industrial community. As noted in the General Plan of the city, "Milpitas will be a green-belt city of 55,000 that has 'balanced' its local and regional roles through the integration of a highly amendable residential community and a thriving regional industrial center" (Reference 6). In 1980, Milpitas had a population of almost 38,000 (Reference 7); thus, Milpitas will likely experience an increase of approximately 17,000 people in the coming years. This growth is intended to follow a specific pattern.

> The form of Milpitas will be relatively compact. On the west, urbanization is confined by the Coyote River and on the east by the Calaveras Foothills (with selected intrusion of hillside development). The Coyote River Park and the Ed Levin Regional Park ensure permanent open space at the boundaries of the Planning Area. On the north and south definition and separation is provided by future South Bay Freeway and the Montague Expressway. The Town Center will be the 'heart' of Milpitas civic, cultural, business and professional life. Residential districts will provide a variety of density patterns and dwelling types suitable for persons or families in all stages of the life cycle. A park-like setting will be created by a series of local parks, school sites, and a greenway system laced throughout all living areas (Reference 6).

The pattern of development within Milpitas is heavily influenced by the local topography. Of the 15,553 acres within the planning area, 8830 acres (57 percent), are hillside acreage (Reference 6). Within this area, only lower density residential uses are permitted in the General Plan. This area also includes the 600-acre Levin Regional Park and 2500 acres of watershed regional preserve. The valley floor area totals 6723 acres; this constitutes 43 percent of the gross acreage in the planning area. It is on the valley floor that industrial and 2500 acres of watershed regional perserve. The valley floor area totals 6723 acres; this constitutes 43 percent of the gross acreage in the planning area. It is on the valley floor that industrial and commercial uses occur in addition to residential uses. However, approximately 2470 acres of this area are reserved for residential uses in the General Plan. The vast majority, 2100 acres, is zoned R1 Residential (single-family). The remaining 370 acres are slated for medium-and high-density residential uses.

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Industrial uses constitute the next largest category of development. A total of 1380 acres are reserved for manufacturing, and an additional 460 acres are designated for industrial parks.

> The industrial core of Milpitas is the 1,000 acre block of land between Calaveras Boulevard and the Montague Expressway. A second 160-acre manufacturing area is in the southeastern quadrant of the Nimitz Freeway and the proposed South Bay Freeway, and a third manufacturing area consists of 220 acres west of the Nimitz Freeway and north of the Milpitas-Alviso Highway (Reference 6).

Commercial activities are provided in the Town Center and in retail subcenters. The Town Center, located north of Calaveras Boulevard,

> ...will be the functional and visual focus of Milpitas. In the approximate center of the Planning Area, it will be accessible to residents and commuters and will be distinguished by a variety of commercial and civic activities...The total area of the Town Center is 110 acres (Reference 6).

The retail subcenters total approximately 140 acres. In addition to the commercial strip on Main Street, "six subcenters, between 8-12 acres in size, are distributed throughout the city" (Reference 6).

The above land uses are only projections in many cases. They are taken from the General Plan as revised in October of 1975; considerable projected development has yet to occur in many areas. However, since its incorporation in 1954, Milpitas has been very conscious of the necessity to plan its development. Thus, actual development patterns will likely follow the projections.

Milpitas is served by a network of freeways, expressways, and major arterials. The Nimitz Freeway connects Milpitas with Fremont, Hayward, Oakland, and other cities to the north and with San Jose to the south. The Sinclair Freeway (Interstate Highway 680), located east of Nimitz Freeway State Highway 17, provides another highspeed, limited-access route to other East Bay communities. The proposed South Bay Freeway would link Interstate Highway 680 to the Expressway, running roughly east-west, connects Milpitas with San Jose and Santa Clara. U.S. Highway 237 (Alviso-Milpitas Road), links the city with Sunnyvale to the west. Within the city itself, major north-south arterials include North and South Main Streets, and Park Victoria Drive. East-west arterials include Dixon Road, Jacklin Road, Calaveras Road, Yosemite Avenue, and Landess Avenue.

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Milpitas is also served by rail and by several airports. The Southern Pacific Railroad and Western Pacific Railroad provide freight service to the city, and several industrial sites have spur lines. Oakland International Airport is located approximately 30 miles to the north, and San Jose Metropolitan Airport is less than 10 miles to the south. The city is also served by a number of general aviation facilities within a range of 20 miles. San Francisco International Airport is approximately 35 miles northwest, across the San Francisco Bay.

Milpitas has a wide range of terrain within its corporate limits. "The hillside area consists of a series of parallel hills and valleys oriented generally northwest-southeast. Elevations range from 40 feet on Evens Road on the west to 2,337 feet in Los Buellis Hills, in the northeast corner" (Reference 6). On the valley floor, elevations decrease toward the west, approaching sea level near San Francisco Bay. As noted in the General Plan,

> The hillside topography is basically determined by the Tularcitos Syncline, the dominant geologic structure in the area, which was formed by intense folding. The generally folded and sheared character of the hillside area was created primarily by the uplift of the Diablo Range, and secondarily by seismic activity along the Hayward Fault Zone and the Calaveras Fault Zone...Two major traces of the Hayward Fault traverse the lower foothills in a northwesterly and southeasterly direction. In addition, the Crosley Fault is noted as following the extreme westerly base of the foothills (Reference 6).

The climate in Milpitas is characterized by warm, dry summers and cool, moist winters. In its early days, Milpitas was known for its beneficial climate; its fruit growing prowess attests to the mildness of the weather. Average temperatures range from 46°F in the winter to 71°F in the summer. Annual precipitation in the area averages approximately 15 inches, although some years have recorded in excess of 25 inches. Most of the annual precipitation, approximately 98 percent, occurs during the period from October through May. Violent thunderstorms, snowfall, and other extreme weather conditions are rare.

Milpitas rests on an alluvial plain at the base of the Diablo Range. The valley floor has been the site of at least two periods of alluvial fan development.

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> Beginning at the base of the foothills deposits range from older fans of course sand and gravel deposited by the Calera, Tularcitos, Los Coches, and Berryessa Creeks. The central band of young interfluvial basin deposits of mainly organically-rich clay and silty clay surrounds a limited deposit of older San Francisco Bay mud...The western most geological materials are fluvial deposits of the Coyote Creek along the outer edges of the alluvial fan deposits of the Penitencia Creek (Reference 6).

Approximately 40 percent of the soils within Milpitas are Class I, II, or III, the best soils for long-term agriculture. These soils include "...Campbell Clay Loams, Clear Lake Clay, Cropley Clays, Orestimba Clays, Mocho Lomes, Ricon Clays, Sunnyvale Silty Clays, and the Yolo Loams" (Reference 6).

Reflecting the climate and soils of the area, the vegetation in Milpitas is varied. The valley floor features oaks, eucalyptus, and a wide variety of fruit trees. Numerous cultivated trees and plants, including citrus, flourish throughout the city. Reflecting the beneficial environment, almost anything can be grown in Milpitas, even palm trees.

All surface water originating in, or passing through, Milpitas ultimately discharges into San Francisco Bay. Runoff is collected in an underground storm drainage system that discharges into the creeks within the city. There are three major drainage basins within or adjacent to Milpitas, all drain from south to north. From west to east, these are Coyote Creek, Lower Penitencia Creek, and Berrywssa Creek. Piedmont, Los Coches, and Calera Creeks are all tributaries of Berryessa Creek. Berryessa Creek drains into the lower portion of Lower Pentencia Creek and Lower Penitencia Creek drains into Coyote Creek near the San Francisco Bay. East Penitencia Creek is a tributary of Lower Penitencia Creek. Coyote Creek flows adjacent to the western corporate limits of the city.

The principal watercourse in the city is the Coyote River. Los Coches, Berryessa, Penitencia, Calera, and Tularcitos Creeks also flow through the area. The 75-mile long Coyote River is the primary natural drainage facility for the east side of the Santa Clara Valley. Milpitas has experienced flood conditions of varying degrees on several occassions.

> Within the Planning Area there are two major patters of flooding based upon the 100-year storm. The first pattern is created by the Coyote River overflowing its banks and flooding an area generally north of the Hetch-Hetchy pipeline and west of State Highway 17 (Reference 6).

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The second pattern is caused by tributary creeks and flood control channels overflowing, due to their limited capacity in relation to a 100-year storm.

Drainageways in Milpitas are a combination of natural channels (creek beds) and channels altered by man. Runoff, originating in the city, drains to these channels through an underground storm drainage system. The general drainage pattern in Milpitas is from southeast to northwest. All drainage is ultimately conveyed to San Francisco Bay.

2.3 Principal Flood Problems

Information on past flooding of the streams under investigation is somewhat limited in Milpitas because of the small population and rural nature of the flood plain areas prior to 1950. Investigation of flooding since 1889 indicates that flood conditions and flood damage were experienced in portions of Santa Clara County in December 1889, January 1911, December 1931, Decmeber 1937, February 1940, April 1941, November 1950, January 1952, December 1955, April 1958, October 1962, January 1963, January 1968, February 1973, and January, February, and March 1983. However, for the area under study, the flood conditions which existed in 1955, 1958, 1962, 1963, 1973, and 1983 produced the only appreciable flooding.

Flooding in early years was often viewed as an asset rather than a liability. The need for water to irrigate agricultural crops outweighted the damage done by floodwaters. In later years, as development increased, damage became a more important consideration. The increase in the population between the years 1950 and 1970, coupled with the installation of water-retention facilities in the area, drastically altered the profile of potential flooding.

The severity of the floods, and the relative development of the area, vary from year to year. Accordingly, the damage resulting from these floods reflects the prevailing conditions. Both 1955 and 1958 were serious flood years in the county, and Milpitas experienced some damage, although faring better than many neighboring areas.

Until mid-January, 1910-1911 had been an extremely dry year. Then on the 13th of the month, a downpour hit the area. As noted in the January 15th edition of the San Jose Sunday Mercury and Herald,

> The precipitation in the city during the 24 hours ending at 7 o'clock yesterday morning was nearly 4 inches. The rainfall is a recordbreaker, being the greatest for any 24 consecutive hours since the opening of the Weather Bureau station here in 1905.

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Virtually all of the watercourses in the area were affected by the storm, causing widespread flooding.

> Conditions in East San Jose were deplorable...Alum Rock Avenue from the carbarns to King Road is the bed of a running stream. The Arcade Villa tract, overflowed by the Silver Creek, and the Lendrum tract, covered with standing water, are veritable lakes. The cartrack on Alum Rock Avenue is under water, and the baseball diamond opposite the car-barn is an immense pond...the water stood more than two feet deep on the principal streets of the town.
>
> The Guadalupe Creek east of Santa Clara went over its banks in at least six or eight different places, which resulted in a great deal of the land from near Newhall Street, north of College Park to Alviso, being covered with water.

In early March 1911, another storm brought intense precipitation to San Jose. The San Jose Mercury of March 8, 1911, carried the following account:

> Vast sheets of flood waters, discernable in every direction from the top of the First National Bank building yesterday morning, were mute evidence of the fierceness and violence of the storm which raged during the night. San Jose had the appearance of an island.
>
> To the west and south the Guadalupe, Canoas, Los Gatos, and Almaden Creeks rushed along and eddied into the streets and around homes of the city; to the east could be seen the overflow from Silver and Coyote Creeks, and to the north in the dim distance toward Agnew was a vast lake caused by the junction and overflow of the Coyote and Guadalupe Creeks, swelled to rivers by the flood waters of their many tributaries - Silver Creek, the Penitencia, Coanos and Almaden.

On March 7, 1911, the San Jose Mercury described evacuation measures in the city.

> Early this morning the patrol-wagon and policemen were still busy rescuing people from their flooded houses in a district about 1 mile long between the Guadalupe Creek and Palm Street. The creek broke its banks above Humboldt Street and spread over the county to the east for a distance of six blocks to a depth of from three to four feet.

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The Santa Clara Valley received heavy precipitation in the winter of 1913-1914. However, while Gilroy and Saratoga had appreciable flooding, San Jose was not affected. The watercourses in the area ran full, but basically stayed within their banks. As recorded in the January 1st edition of the San Jose Mercury,

> Guadaulpe Creek is wide and swift, and is only a few feet below the bridge. Coyote and Los Gatos Creeks are high, almost to flood levels...Coyote Creek was reported up to its banks...and Saratoga Creek has damaged bridges and caused washouts.

Milpitas enjoyed a considerable degree of immunity from the flood-waters of December 1955. As recorded in the Milpitas Post of December 29, 1955,

> Milpitas was virtually a lone, dry island in a very wet Santa Clara County last Friday as heavy and continuous rains brought evacuation for several hundred county families.
>
> The lone Milpitas flood condition was present... before the heavy rains hit. The 'lake' created by the closing by Southern Pacific of a drainage ditch along its right of way, was still in place on Botelho Avenue...Coyote Creek near Milpitas and the new Western Pacific drainage canal east of town were both carrying peak amounts of run-off. Penitencia Creek, diverted south and east of the Ford plant and the almshouse, was carrying only a trickle by comparison.

Not only was the central section of Milpitas spared damage, but the surrounding residential areas were also untouched, as reported in the Milpitas Post on December 29, 1955.

> A Post survey of all Milpitas subdivisions at the peak of the storm showed them with no standing water at all. Culverts and underground storm sewers were free and flowing, as were downtown installations.

Unlike conditions in most of the county, flooding in Milpitas was more severe in 1958 than in 1955. The April 4th edition of the Milpitas Post gave the following description of conditions:

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> ...saturated ground...severe crop damage...trees endangered...puddling in commercial areas...no serious problems in residential areas...creeks running full and fast...construction work stymied... That in a nutshell is the story of the unseasonal rainfall which has inundated with almost maddening frequency the Milpitas area as well as the rest of northern California. In neighboring Alviso the flood story was the same as in many past years-- all bad.

Principally as a result of the lateness of the storm, damage to agricultural crops was high. As recorded in the Milpitas Post on April 4, 1958, "Hardest hit by the rains are local orchardists who say the losses will be more than 50 percent of the expected crop."

Unlike 1955, runoff caused some major problems throughout Milpitas.

> Although no serious problems were caused in residential areas, large volumes of water this week swept over the highly saturated ground...
>
> At Milford Village a flash shower early Tuesday morning dumped one and a half inches of rain. The run-off spilled out of the Los Coches Creek and moved through the subdivision spilling out finally across Dempsey Road in a vast sheet ranging up to six inches in depth.

The early storm of October 1962 caused some minor flooding in Milpitas. As in previous years, Milpitas experienced less damage than the majority of neighboring communities. As reported in the Milpitas Post of October 17, 1962,

> A temporary lake formed at Whittier and Spence in Milpitas Manor... The low-lying spot was about the wettest in Milpitas during the nearly 4-inch downpour on the weekend, but caused no home flooding or other damage other than some wet brake linings to cars which plowed through. The scene was a distinct contrast to other areas in the county and state which sustained considerable damage and even deaths from floods, mudslides and high winds... Nearby Alviso was flooded again, but not to the point of evacuating inhabitants of the town at the foot of the bay...

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> Just about all of Milpitas stayed high and relatively dry as neighboring county cities battled flooded homes and roads during last weekends deluge, the tail-end of two squalls far out in the Pacific Ocean...

The February 6, 1963, issue of the Milpitas Post described flooding in the Alviso area as a result of a storm in the last week of January 1963. While other areas of the county suffered from flood conditions of varying severity during this storm, Milpitas experienced only nuisance variety flooding, such as standing water and puddles at intersections. No damage was reported in Milpitas.

In contrast to previous years, Milpitas had more serious flood conditions in 1973 than many other areas in the county. The downtown section of town was affected as were residential areas. As noted in the January 24th edition of the Milpitas Post,

> Last week's storm dropped a lot of water on Milpitas...Main Street and some of the Curtner-Manor area suffered the most...Main Street at Weller was about the deepest area of flooding.

The description of the flooding in the Milpitas Post included a statement by the city's public works director concerning the source of the water.

> Public Works Director Charlie McDonald said that most of the water came from the Berryessa and Penitencia Creek channels and that the storm problem was compounded by unusually high tides in the Bay, backing water up in the creeks.
>
> 'We measure the Berryessa by how high it gets on the railroad crossing,' McDonald said. 'Last Wednesday it covered the girders and that's the highest I've ever seen it...'

The article concluded with a statement concerning the recourses open to homeowners to recoup their damages.

> If Milpitas homes or property are damaged by floods, owners can forget about filing an insurance claim. Floods aren't covered under regular homeowner's policies, and Milpitas has declined to participate in a national program of flood insurance.

In early 1983, a series of storms caused extensive flooding in Milpitas, as well as in Santa Clara County as a whole. The first of these storms, which occurred in late January, caused street flooding along most of the drainageways in Milpitas. Flooding along Berryessa Creek between Yosemite Drive and Calaveras Boulevard caused water and sediment damage to businesses in this area (Reference 1).

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The second in this series of storms, which occurred in early February, only caused flooding of streets and yards. No flood damage was reported (Reference 1).

The third storm occurred in late February and early March. Again, most flooding was confined to streets, parking areas, and yards; however, damage in many areas was averted only through emergency sand-bagging (Reference 1).

2.4 Flood Protection Measures

No Federal flood control facilities exist on the streams of Milpitas. However, local interests have provided drainage or reservoir projects which affect flood damages within the town.

Berryessa Creek, from the confluence with Lower Penitencia Creek to Calavaras Boulevard, was realigned and improved by local developers in conjunction with the Santa Clara Valley Water District and the Miliptas Department of Public Works.

Calera Creek, from the confluence with Berryessa Creek to Escuela Parkway, was improved similar to that of Berryessa Creek.

Other local improvements have consisted of bridge and culvert construction, and, in some cases, they are not adequate to contain the 100-year floodflows.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

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3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

Flood hydrographs and peak flow rates for the 10-, 50-, 100-, and 500-year floods for streams studied by detailed procedures were based on rainfall-runoff computations and regional regression equations developed by the Santa Clara Valley Water District (Reference 8).

The regional regression equations are based on the frequency statistics of the records of 20 stream gages in Santa Clara County and surrounding areas. The parameters used in the regional regression equation consist of the drainage area of the basin, mean annual precipitation, characteristic and drainage lengths of the basin, and slope of the main drainage course of the basin. With these parameters, the statistics of the peak flow rate and 24-hour flow volume can be determined through use of the regession equations.

Drainage areas were broken down ito smaller subbasins. The HEC-1 computer program (Reference 9) was used with the Santa Clara Valley Water District 24-hour storm pattern and storm depth to produce subbasin hydrographs. For rural areas, the hydrographs were balanced using HEC-1 to reflect both the peak flow rate and 24-hour volume as predicted by the regional regression equations. For urban areas, the hydrographs were based on runoff coefficients from the Santa Clara Valley Water District Urban Hydrology Methodology (Reference 10). Actual storm drain capacities were included for routing these hydrographs.

The effects of channel and valley (overbank) storage floodflow rates were determined by developing storage-discharge relationships for reaches of each stream. In detailed study reaches, the storage-discharge relationships were developed by computing a series of water-surface profiles for various flow rates and determining the storage in the reach for each outflow rate. Flood hydrographs from the smaller subbasins were combined and routed downstream using the Modified Puls routing procedure. For reaches outside of the limits of detailed study, storage-discharge relationships were generally obtained from normal depth computations.

Flood hydrographs for streams studied by approximate methods were calculated only when required to complete the detailed study analysis. Relative flood magnitudes for other streams studied by approximate methods were based on historic information, existing hydrologic analyses, available watershed information, and field observations.

Peak discharge-drainage area relationships for Berryessa Creek, Lower Penitencia Creek, and East Penitencia Creek are shown in Table 1.

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Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second) 10-Year	50-Year	100-Year	500-Year
Berryessa Creek					
At Confluence With Sierra Creek	7.7	1230	2250[1]	2580[1]	3090[1]
At Morril Avenue	7.7	1230	1700[1]	1750[1]	1800[1]
Downstream of Montague Expressway	8.8	800[1]	800[1]	800[1]	800[1]
Downstream of Confluence With Arroyo Los Coches	15.1	1040	1500	1500[1]	1580[1]
At Confluence With Tularcitos Creek	17.0	1250	2120	2120	2280
At Confluence With Wrigley Ditch	18.6	1620	2350	2350	2480
At Confluence With Calera Creek	21.5	1870	2730	2730	2890
Lower Penitencia Creek					
Downstream of Trimble Road	2.0	320	1060[2]	1510[2]	1620[2]
Downstream of Confluence With East Penitencia Creek	3.7	800[3]	1670[3]	2150[3]	2840[3]
At South Main Street	3.7	700[3]	1120[3]	1120[3]	1120[3]
At Capitol Avenue	4.0	740	1200[3]	1210[3]	1220[3]
At Redwood Avenue	5.2	850	1150[3]	1150[3]	1150[3]
At Confluence With Berryessa Creek	26.7	2550	3700	3700	3700
Downstream of Confluence With Berryessa Creek	26.7	2550[1]	2600[1]	2600[1]	2600[1]
At Nimitz Freeway	27.7	1750[1]	3500[1]	3500[1]	3500[1]
East Penitencia Creek					
Upstream of Trimble Road	1.6	280	400[1]	450[1]	540[1]
Downstream of Trimble Road	1.6	280	340[1]	340[1]	340[1]
Upstream of Confluence With Lower Penitencia Creek	1.7	480	970[2]	1080[2]	1280[2]

[1] Reduction In Flow Rate Due to Capacity Restriction
[2] Increase In Flow Rate Due to Spills From Neighboring Subbasins
[3] Reduction In Flood Rate Due to Storage Behind Railroad

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Tidal elevations in San Francisco Bay were developed by the U.S. Army Corps of Engineers, San Francisco District (Reference11). The 100-year tide level of 7.49 feet was coordinated with the U.S. Army Corps of Engineers.

Elevations for floods of the selected recurrence intervals on San Francisco Bay are shown in Table 2.

Table 2. Summary of Elevations

Flooding Source and Location	Elevation (Feet) 10-Year	50-Year	100-Year	500-Year
San Francisco Bay At Milpitas	7.0	7.0	7.49	8.0

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of streams in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each stream studied in the community.

Flood elevations were computed through the use of the U.S. Army Corps of Engineers HEC-2 step-backwater computer program (Reference 12) and supplemented by hand calculations where required.

Cross sections for backwater analysis were located at small intervals upstream and downstream from bridges and culverts and other hydraulically significant features in order to establish the backwater effect of such structures in areas that are either urbanized or potentially subject to development. All bridges and culverts were measured to determine channel geometries at flow restrictions.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1).

Topographic data for channel cross sections were obtained from existing plans (Reference 13) and topographic mapping (Reference 14), supplemented with aerial photogrammetric (Reference 15) and field survey data as necessary.

Roughness factors (Manning's "n") for hydraulic computations were assigned on the basis of field inspection of flood plain areas. Within the City of Milpitas, roughness values ranged from 0.015 to 0.045 in the channels and from 0.018 to 0.040 on the overbanks.

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The starting water-surface elevations for Lower Penitencia Creek were based on water-surface elevations from the U.S. Army Corps of Engineers report for Coyote Creek (Reference 16). Starting water-surface elevations for Berryessa Creek were based on the water-surface elevations for Lower Penitencia Creek. Water-surface elevations for Calera Creek were based on water surface elevations on Berryessa Creek. Starting water-surface elevations for East Penitencia Creek were based on water-surface elevations on Lower Penitencia Creek.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1).

Many areas of Milpitas are subject to sheet flow; that is, shallow overland flooding that is generally less than 3 feet deep and characterized by unpredictable flow paths. The water-surface elevations of flooding in these areas are essentially independent of those along the adjacent streamway and are affected principally by obstructions in the flooded area.

The hydraulic analyses used for sheet flow flooding were based on surveyed and photogrammetric elevations (Reference 15) field investigations by experienced engineers, and hand calculations based on normal depths. Areas where overflow from channels or runoff in excess of storm drain capacity would collect and pond were evaluated as part of the sheet flow flooding investigations.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Areas subject to tidal inundation include all areas lower than the 100-year tide (Reference 2) that are not protected by an adequate, maintained levee system. Wave runup due to tsunami events was also considered. However, based on previous studies (Reference 17) wave runup in the Milpitas area is not as significant an event as the 100-year tidal elevation of 7.49 feet, for insurance purposes.

Flooding for creeks studied by approximate methods was established according to the professional judgment of engineers familiar with the region, taking into account flood elevations estimated from available data, existing hydrologic and hydraulic analyses, correlations with similar streams, and field observations.

Improvements to Calera Creek, designed to contain the 100-year flood, have led to the elimination of this creek from the study as a detailed study reach.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps.

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4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program (NFIP) encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:600 and 1:1,200, with a contour interval of 2 feet (References 13 and 14), and developed photogrammetrically, using aerial photographs at a scale of 1:6,000 (Reference 15).

The 100- and 500-year flood plain boundaries are shown on the Flood Boundary and Floodway Map (Exhibit 2). In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year flood plain boundary is shown.

4.2 Floodways

The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights.

Unlike typical floodway cross sections, the channels in Milpitas have no overbank areas that allow a continous water-surface across the channel and the overbanks. In general, overbank areas are lower than the bank elevations so that, once water overtops the channel banks, it flows along its own path as sheet flow. Floodways are not applicable in sheet flow areas; therefore, no floodway table is included. Forcing floodwaters to stay within channel banks during the 100-year flood by placing imaginary encroachments could lead to worsening of downstream overflow and subject new properties to flooding.

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Due to the extensive sheet flow in the flood plains and the extent of urbanization in the community, no floodways were designated on the channels studied in Milpitas.

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting the City of Milpitas.

5.1 Reach Determinations

Reaches are defined as sections of flood plain that have relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of Milpitas are shown on the Flood Profiles (Exhibit 1) and summarized in Table 3.

For channels designated "Zone A contained in channel," no reach determinations were made because they do not lend themselves to FEMA criteria.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest one-half foot, multiplied by 10, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10-

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
San Francisco Bay Reach 1	0001	-0.49	-0.49	1.0	005	A1	7
Sheet Flow	0001,0003	N/A	N/A	N/A	N/A	A0	Depth 1
Sheet Flow	0003	N/A	N/A	N/A	N/A	A0	Depth 2
Ponding	0001	N/A	N/A	N/A	N/A	AH	10
Ponding	0001,0003	N/A	N/A	N/A	N/A	AH	12
Ponding	0001	N/A	N/A	N/A	N/A	AH	13
Ponding	0003	N/A	N/A	N/A	N/A	AH	16
Ponding	0003	N/A	N/A	N/A	N/A	AH	17
Ponding	0003	N/A	N/A	N/A	N/A	AH	19
Ponding	0003	N/A	N/A	N/A	N/A	AH	20
Ponding	0001,0003	N/A	N/A	N/A	N/A	AH	24
Ponding	0003	N/A	N/A	N/A	N/A	AH	26
Ponding	0003	N/A	N/A	N/A	N/A	AH	33
Ponding	0003	N/A	N/A	N/A	N/A	AH	35
Ponding	0003	N/A	N/A	N/A	N/A	AH	46
Ponding	0003	N/A	N/A	N/A	N/A	AH	49

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MILPITAS, CA

(SANTA CLARA CO.)

FLOOD INSURANCE ZONE DATA

SAN FRANCISCO BAY-SHALLOW FLOODING

and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

FHFs are derived from standard reach determinations; therfore, they do not apply in the City of Milpitas, with the exception of San Francisco Bay.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zone A0:	Special Flood Hazard Areas inundated by types of 100-year shallow flooding where depths are between 1.0 and 3.0 feet; depths are shown, but no FHFs are determined.
Zone AH:	Special Flood Hazard Areas inundated by types of 100-year shallow flooding where depths are between 1.0 and 3.0 feet; base flood elevations are shown, but no FHFs are determined.
Zone A1:	Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike, levee, or other local water-control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flood hazard; not subdivided.

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In this study, channels studied by detailed methods in which the flood hazard is within the channel have been designated Zone A.

The flood elevations differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community are summarized in Table 3.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Milpitas is, for insurance purposes, the principal product of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole-foot water-surface elevation of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the NFIP.

In general, most of the City of Milpitas is designated as Zone B. The limited capacity of the storm drainage system will subject almost all of the city to shallow sheet flow during the 100-year flood as floodwaters in excess of the storm drain capacity flow down streets.

6.0 OTHER STUDIES

A Flood Hazard Boundary Map for the City of Milpitas was published by the Federal Insurance Administration in 1974, and revised in 1975, 1977, and 1978 (Reference 18). Flood hazard zones designated on the Flood Insurance Rate Map (published separately) for Calera, Coyote, Berryessa, East Penitencia, and Lower Penitencia Creeks are contained within the previously published special flood hazard areas.

In their Coyote Creek Flood Plain Information report (Reference 14), the U.S. Army Corps of Engineers published flood situations that at that time were substantially similar; however, the flood profiles and flood plains were different for several reasons. First, some subsidence has occurred in the lower reach of Coyote Creek. Second, the placement of levees for drying lagoons on either side of the creek near the Milpitas Sanitary Treatment plant have raised water elevations. Finally, a number of channel modifications and improvements have occurred and are included in this study.

The tidal elevations were coordinated with the U.S. Army Corps of Engineers, (Reference 17) who agreed that the value used in this study was based on the best available information.

The study is authoritative for the purposes of the NFIP; data presented herein either supersede or are compatible with all previous determinations.

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7.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Building 105, Presidio of San Francisco, San Francisco, California 94129.

8.0 BIBLIOGRAPHY AND REFERENCES

1. Santa Clara Valley Water District, Report on Flooding and Flood Related Damages, Santa Clara County, January 1 to April 30, 1983, October 1983

2. A.L. Kroeber, Handbook of the Indians of California, Berkeley: California Book Company, 1967

3. City of Santa Cruz Museum, Permanent Display of American Artifacts, Santa Cruz, California

4. George G. Bruntz, The History of the Indians of California, Fresno: Valley Publishers, 1971

5. Shoenaid Khorsand and Alice Marshall, Lingering Legacy - A Historical Tour Guide in and Around the Santa Clara Valley, Local History Studies, Vol 12, Gilroy: De Anza College, California History Center, 1973

6. City of Milpitas, City of Milpitas General Development Plan, Milpitas: City of Milpitas, California, Adopted 1964, Amended 1975

7. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population, March 1982

8. Santa Clara Valley Water District, Draft Report, Development of Regional Regression Equations for Solution of Certain Hydrologic Problems in and Adjacent to Santa Clara County, November 1976

9. U.S Department of the Army, Corps of Engineers, Hydrologic Engineering Center, HEC-1 Flood Hydrograph Package, January 1973

10. Santa Clara Valley Water District, Urban Hydrology Methodology, March 1976

11. U.S. Department of the Army, Corps of Engineers, San Francisco District, Estimate of the 100-Year Tide for Flood Insurance Studies, unpublished

12. U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles, Generalized Computer Program, Davis, California, October 1973

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13. Santa Clara Valley Water District, Coyote Creek Improvement Plans, Scale 1:6,000, April 27, 1977

16. U.S. Department of the Army, Corps of Engineers, San Francisco District, Flood Plain Information, Coyote Creek, February 1970

17. U.S. Department of the Army, Corps of Engineers, Waterways Experiment Station, Hydraulics Laboratory, Technical Report H-75-17, Tsunami Predictions for Monterey and San Francisco Bays and Puget Sound, Vicksburg, Mississippi, November 1975

18. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, City of Milpitas, California, Scale 1:12,000, March 22, 1974 (Revised March 28, 1975; July 12, 1977; and May 30, 1978)

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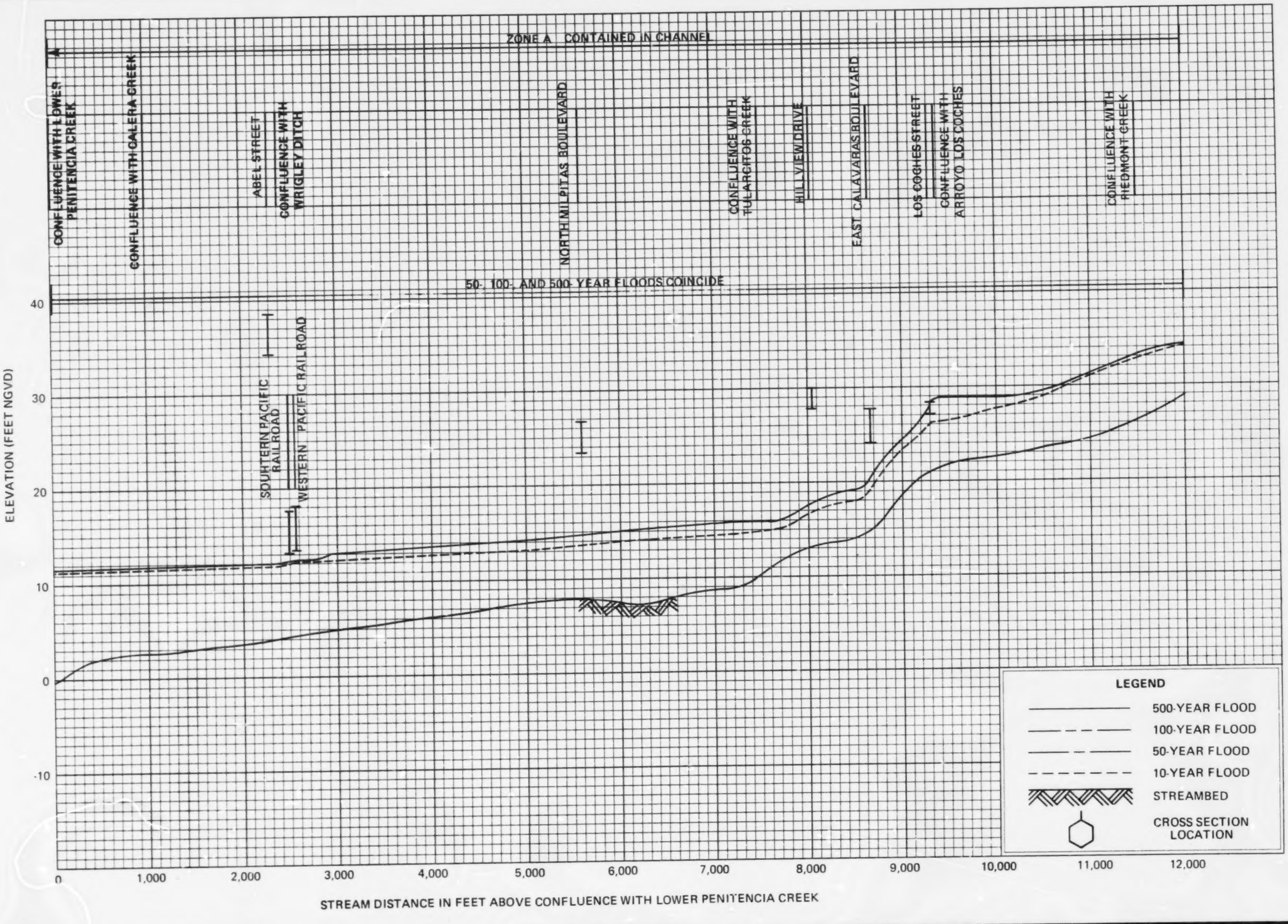

FLOOD PROFILES

BERRYESSA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MILPITAS, CA
(SANTA CLARA CO.)

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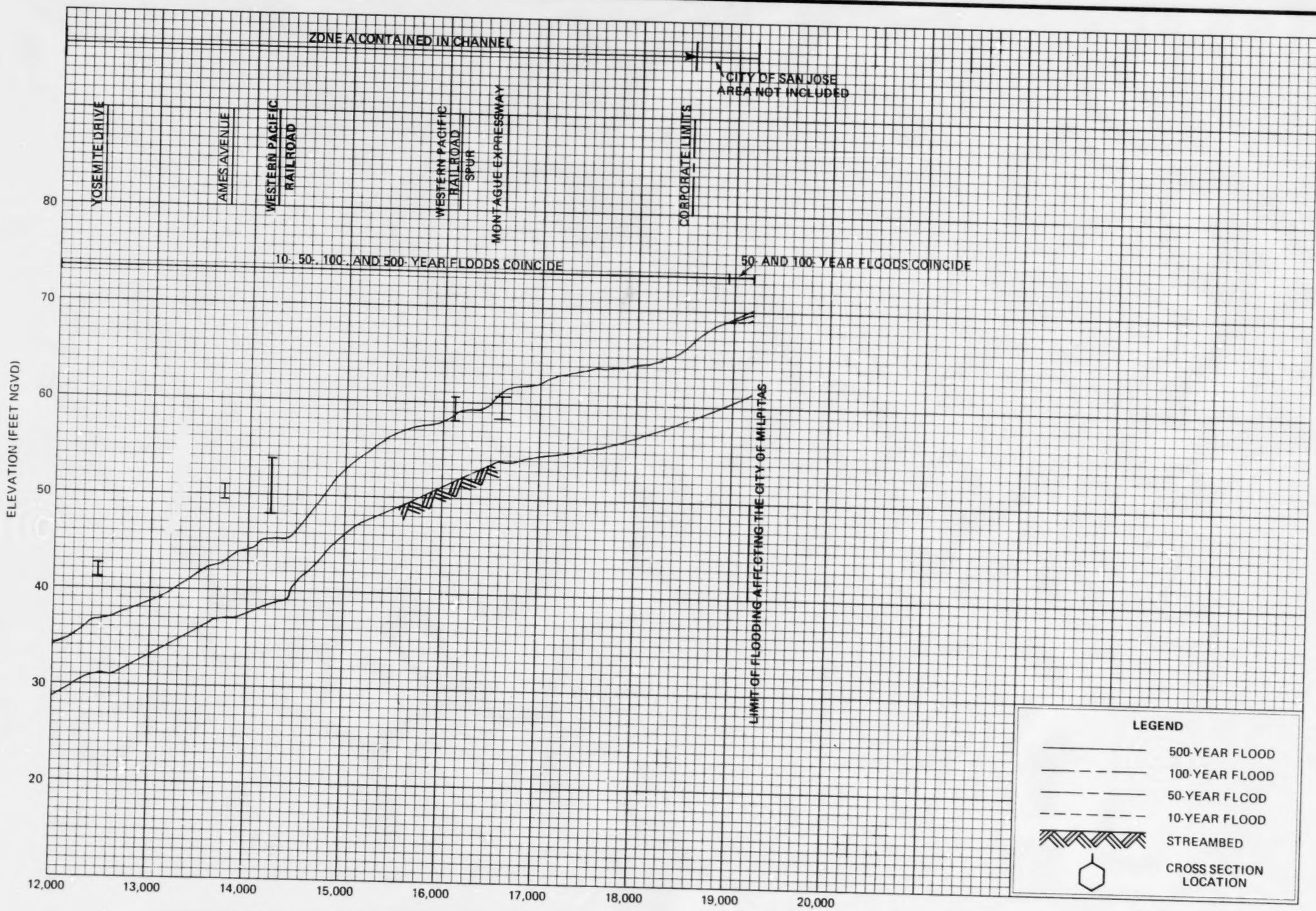

FLOOD PROFILES

BERRYESSA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MILPITAS, CA
(SANTA CLARA CO.)

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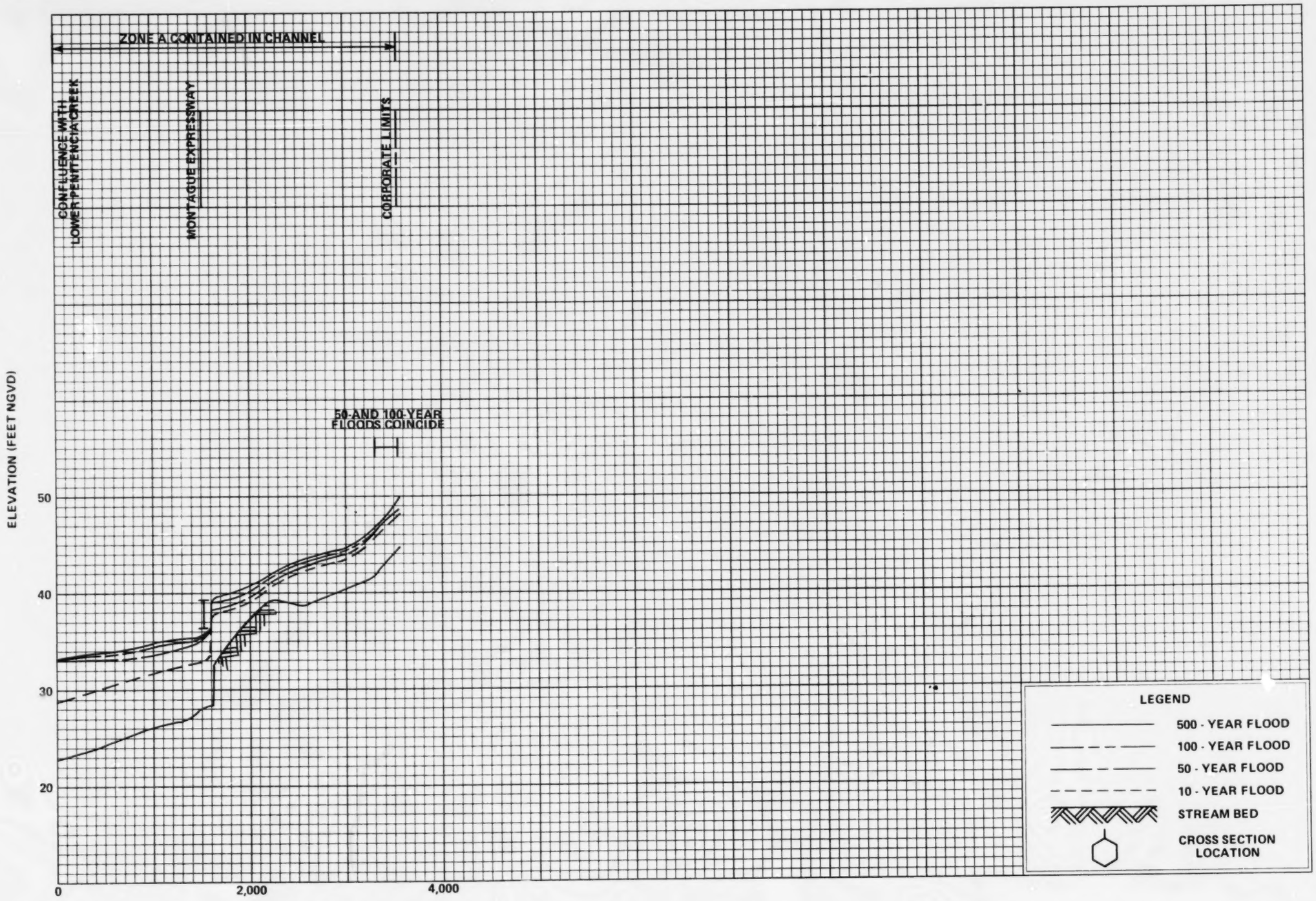

FLOOD PROFILES

EAST PENITENCIA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MILPITAS, CA
(SANTA CLARA CO.)

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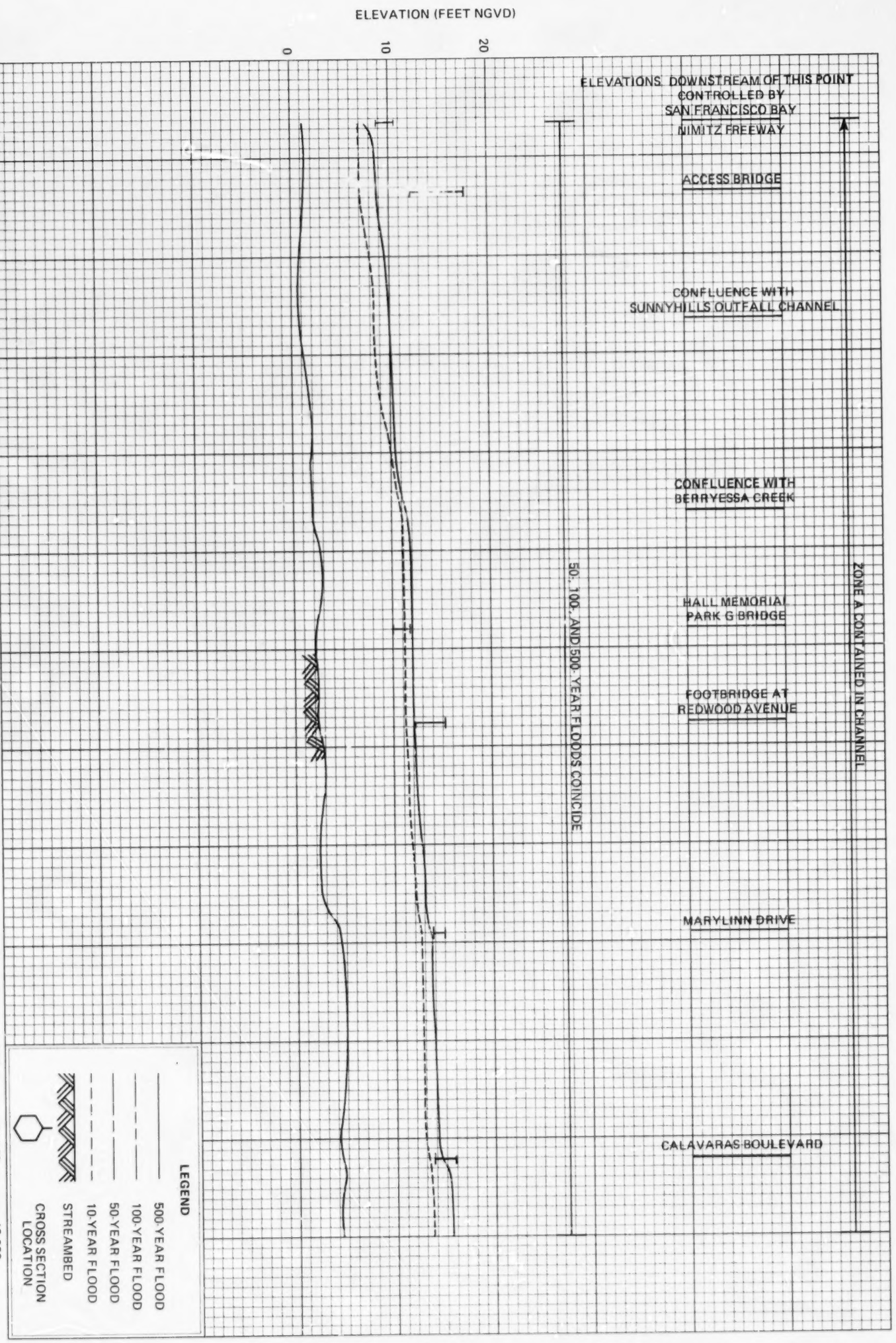

04P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF MILPITAS, CA (SANTA CLARA CO.)	FLOOD PROFILES LOWER PENITENCIA CREEK

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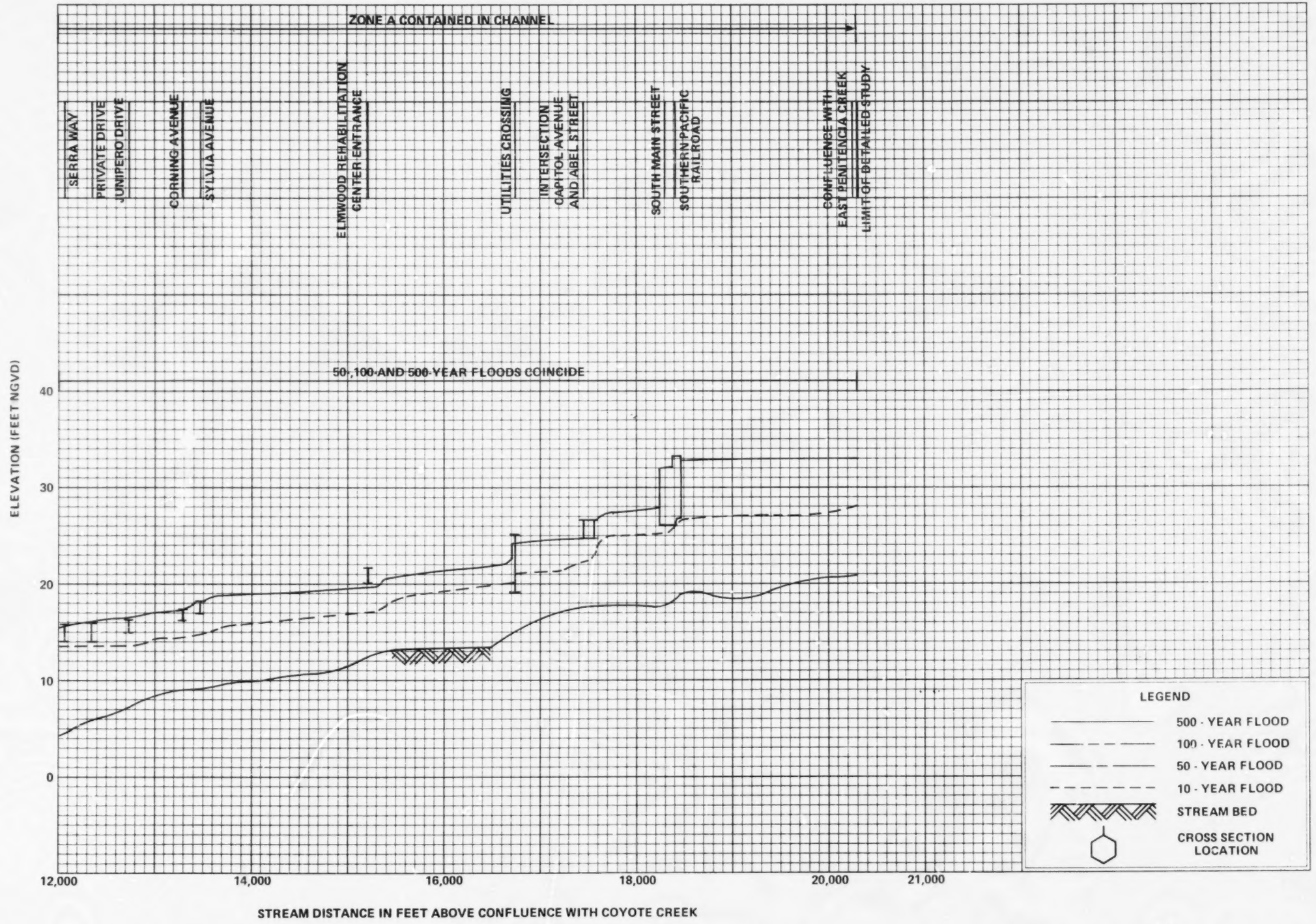

FLOOD PROFILES

LOWER PENITENCIA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF MILPITAS, CA
(SANTA CLARA CO.)

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